

Appl. No.: 10/699,446
Amdt. Dated: January 22, 2007
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Amendments to the Specification

In the specification, please amend paragraph [0011] to read:

After consolidation, preform aperture 26 will be closed at preform end 34, as shown in FIG. 3, due to the presence of the closed capillary plug. If no plug is employed the entire aperture 26 will remain open. In this event aperture 26 is closed at preform end 34 after consolidation by a technique such as heating and pinching the same.

In the specification, please amend paragraph [0044] to read:

One method that may be employed to decrease the manufacturing cost of an optical fiber preform is to increase the deposition rate of glass soot. Achieving an increased deposition rate has lead to widespread use of multiple soot-producing burners. Although the use of multiple burners to deposit glass soot has produced the desired increases in deposition rates, the high temperature produced at the surface of the glass core cane may undesirably increase the amount of water adsorbed into the glass. Single burner deposition, although typically employing a similar flame temperature as multiple burner deposition, tends to produce a lower surface temperature than multiple-burner deposition. As a single burner flame traverses the length of a glass rod, the localized surface of the rod adjacent the burner flame experiences a period of time between passes of the flame where it cools. The cooling reduces the adsorption of water into the surface of the core cane. The reciprocating relative motion between the burner and the core cane produces a periodic heating and cooling cycle which forms an envelope representing the overall temperature of the glass rod as a function of time. The temperature envelope for a single burner deposition process is typically lower than the temperature envelope for a multiple burner burner deposition process.

Please amend paragraph [0059] to read:

[0001] The rapid forward and reverse traverse rates which may be employed during the deposition process may impart considerable wear on the moving elements responsible for

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the traverse of the components included in the deposition apparatus, particularly at the turnaround points, because of rapid acceleration and deceleration thereat. By turnaround point we mean the point or points at which moving elements of a deposition apparatus change their direction of motion. This consideration is directed primarily at translational movement of the deposition burner or burners, movement of the core cane, or movement of both the burner or burners and the core cane, wherein a reciprocating relative motion is developed between the burner or burners and the core cane. That is, the point or points at which the reciprocating motion of either the burner or burners, and/or the core cane changes direction. Illustrated in FIG. 10 is a deposition lathe 74 having carriage 76 mounted for reciprocating motion on guide rods 78. In the embodiment depicted in FIG. 10, relative motion between burner 20 and core cane 46 is provided by traversing core cane 46 relative to burner 20. Carriage 76 includes chucks 80 for mounting core cane 46 to carriage 76 and a motor 82 for rotating core cane 46. Carriage 76 is connected to guide rods 78 by linear bearings 84 located at the ends of carriage arms 86. Carriage 76 cooperates with lead screw 88 such that rotation of lead screw 88 results in linear motion of carriage 76 along guide rods 78. Referring to FIG. 10, carriage 76 moves in a forward direction, as indicated by arrow F, and in a reverse direction as indicated by arrow R. The direction of travel and speed of travel of carriage 76 along guide rods 78 depends upon the direction of rotation and rotational speed of motor 90 connected to lead screw 88. Damping devices 92 and 94 may be installed at or near each respective turnaround point of carriage 76. Preferably, damping devices 92 or 94 functions at least as a damping device, more preferably as both a damping and an accelerating device, for carriage 76 as carriage 76 reaches a turnaround point. Examples of suitable damping devices 92 or 94 include a spring or a shock absorber. The design of such damping devices are well known in the art. One potential supplier of shock absorbers is Enertrols Inc. of Westland, MI. The invention does not require a damping device at each turnaround point. For example lathe 74 may include damping device 92, 94 at only one of the turnaround points. FIG. 11 illustrates an example of a damping device. Damping device 92 (94) as shown in FIG. 11 includes a housing 98 and a piston 100 slidably disposed within the housing. Housing 98 preferably also includes an accumulator

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chamber 102 formed between a portion of housing 98 and movable barrier 104, barrier 104 being slidably disposed within housing 98. Optionally, barrier 104 may be a flexible diaphragm. The space between housing 98 and barrier 104 contains a compressible fluid, such as a gas. Accumulator chamber 102 may include a flexible bladder containing a compressible fluid. Accumulator chamber 102 may be located remotely from housing 98 and connected to housing 98 by a passage wherein accumulator chamber 102 is in fluid communication with housing 98. Piston 100 is perforated by at least one passage 106, wherein a first chamber 108 is in fluid communication with second chamber 110 through passage 106. Chambers 108 and 110 contain a viscous fluid suitable for hydraulic or pneumatic cooperation with piston 100. The fluid may be a liquid, such as an oil, or a gas, optionally the fluid may be a magnetorheological fluid. Preferably, the fluid is an oil. Piston 100 is connected to bumper 112 by piston shaft 114. Spring 116 acts against bumper 112 to extend bumper 112 away from housing 98. Preferably, damping device 92, 94 is capable of evenly dissipating the kinetic energy of reciprocating carriage 76. In the embodiment shown in FIG. 11, linear movement of carriage 76 (shown in FIG. 10) causes carriage 76, or an attachment to carriage 76, to contact bumper 108, causing piston 100 to travel through housing 98 and the viscous fluid. Seal 118 prevents the flow of viscous fluid past the rim of piston 100. An additional seal 120 is located at the periphery of barrier 104. Seals 118 and 120 may be O-rings, for example. Flow of the viscous fluid between chambers 108 and 110 is restricted by passage 106 such that the fluid provides a damping force to the movement of piston 100 through housing 98 and the viscous fluid. The kinetic energy of carriage 76 is dissipated as heat within the viscous fluid, causing carriage 76 to decelerate. As piston 100 is driven into housing 98 by carriage 76, spring 116 is compressed by bumper 112, storing kinetic energy from carriage 74 in spring 116. At the turnaround point, motor 90 reverses rotational direction, causing lead screw 88 to also reverse direction. Carriage 76 is driven in a second direction opposite to the first direction of carriage 76. The kinetic energy from carriage 74 which was stored in spring 116 is released, providing an a return force to bumper 112, causing piston 100 and bumper 112 to reverse direction and act against carriage 76, thereby assisting motor 90 in accelerating carriage 76 and resetting damping element 92.

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Optionally, relative motion may be provided by traversing burner 20, wherein damping device 92, 94 would be suitably employed to decelerate or accelerate burner 20.

Please amend paragraph [0064] to read as follows:

FIG. 12 shows the calculated effect on surface temperature of a single burner traversing adjacent to and parallel with the longitudinal axis of a glass rod during the deposition of glass soot onto the rod. The data show temperature vs. time for the first few forward traverses of the burner flame. The forward traverse rate of the burner was evaluated for three traversing conditions; 30 seconds/pass, shown by curve 122, 60 seconds/pass, shown by curve 124, and 120 seconds/pass as indicated by curve 126. The time required for a pass is interpreted as the time between the burner flame passing a given point on the glass rod during one forward traverse to the time the flame passed the same point during the next forward traverse. The figure shows that the calculated peak temperature varies from between about 550°C to 640°C for the 30 second/pass rate, between about 660°C and 780°C for the 60 second/pass rate and between about 890°C and 960°C for the 120 seconds/pass rate. FIG. 13 illustrates the calculated overall temperature envelope as a function of time for the entire deposition process, and shows an increasing overall temperature as a function of time for a decreasing traverse rate (increasing seconds/pass). Shown in FIG. 13 are calculated temperature envelopes for a single deposition burner traversing at 30 seconds/pass (128), 60 seconds/pass (130), and 120 seconds/pass (132). FIG. 13 also shows that as deposition progresses, and the glass soot layer becomes thicker, the temperature at the surface of the glass rod decreases because of the formation of the insulating glass soot layer.

Please amend paragraph [0068] as follows:

FIG. 18 graphically illustrates the concentration of water in ppm (by weight)- μm in a glass rod upon which a layer of glass soot has been deposited. The figure shows that as the ~~thickness of~~ thickness of the soot layer increases, the amount of water adsorbed into

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the surface of the glass decreases. Note that the decrease is not linear, and that after a relatively thin layer of soot has been deposited, for example, 20 nm, the concentration of water adsorbed into the glass rod reaches a generally constant level. The data indicate that after a soot thickness of about 5 nm the reduction in adsorbed water begins to level, and after a soot thickness of about 20 nm has been deposited, the concentration of water does not change appreciably. The data were collected by performing FTIR analysis on a series of glass rods after varying thicknesses of soot had been deposited. The rods were cut to expose a radial profile, and the radial profile was analyzed to determine the amount of water contained within the glass.

Please amend paragraph [0069] to read:

FIG. 19 shows the OH concentration, in ppm by weight, in three optical fiber preforms. The three optical fiber preforms were manufactured using three, substantially identical core canes. The core canes were manufactured by convention methods, and then overlaid with silica soot, using varying traverse rates, to form composite preforms. The composite preforms were consolidated, and then cut perpendicular to the longitudinal axis of the preforms to facilitate ~~measurement~~ measurement of the preforms. The data represented by curve 150 represents a deposition of glass soot onto a core cane using two soot producing burners at a forward traverse rate of 1.66 cm/s. Curve 152 represents a deposition of glass soot at a forward traverse rate of 10 cm/s using two soot producing burners. Curve 154 represents the deposition of soot using a single soot producing burner at a forward traverse rate of 1.66 cm/s. FIG. 19 shows that, for a dual-burner deposition process, increasing the forward traverse rate by at least 4 times resulted in a significant reduction in the amount of water (in this instance OH), within the consolidated glass cane. Also shown by FIG. 19 is a peak amount of OH at the surface of the core cane of about 0.200 ppm for the case where a fast forward traverse was used, as indicated by curve 152, and wherein the amount of OH at the interface of the core cane-soot, as defined herein (i.e. within 100 μ m of the surface of the core cane), is less than 0.200

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ppm. In FIG. 19, line 156 represents the glass core cane-overclad interface. In this example, a first insulating layer of soot was not deposited.